

STANDARD FORM OPERATIONS

Task 1 – Complete the following operations. Give your answers in standard form.

- 1) $(3.2 \times 10^5) + (4.5 \times 10^5) = 7.7 \times 10^5$
- 2) $(7.1 \times 10^6) - (3.9 \times 10^6) = 3.2 \times 10^6$
- 3) $(5.6 \times 10^4) + (2.3 \times 10^3) = 5.83 \times 10^4$
- 4) $(8.9 \times 10^{-3}) + (1.2 \times 10^{-3}) = 1.01 \times 10^{-2}$
- 5) $(4.7 \times 10^{-2}) - (2.8 \times 10^{-2}) = 1.9 \times 10^{-2}$
- 6) $(3 \times 10^4) \times (2 \times 10^3) = 6 \times 10^7$
- 7) $(5.2 \times 10^5) \times (4 \times 10^{-2}) = 2.08 \times 10^4$
- 8) $(6 \times 10^{-3}) \times (7 \times 10^{-6}) = 4.2 \times 10^{-8}$
- 9) $(8.5 \times 10^2) \times (3.2 \times 10^4) = 2.72 \times 10^7$
- 10) $(9 \times 10^{-5}) \times (2.1 \times 10^3) = 1.89 \times 10^{-1}$
- 11) $(4.8 \times 10^7) \div (1.2 \times 10^3) = 4 \times 10^4$
- 12) $(6 \times 10^{-2}) \div (3 \times 10^4) = 2 \times 10^{-6}$
- 13) $(9 \times 10^6) \div (3 \times 10^2) = 3 \times 10^4$
- 14) $(2.1 \times 10^{-3}) \div (7 \times 10^{-7}) = 3 \times 10^3$
- 15) $(5 \times 10^3) \div (2 \times 10^5) = 2.5 \times 10^{-2}$

Task 2 – Give your answers in standard form.

- 16) The population of Country A is 3.5×10^7 .
The population of Country B is 2.2×10^7 .
Find the total population of the countries.
 $3.5 \times 10^7 + 2.2 \times 10^7 = 5.7 \times 10^7$
- 17) A city has 8.1×10^6 people in 2020. By 2025,
the population increased by 4.9×10^5 .
What is the population in 2025?
 $8.1 \times 10^6 + 4.9 \times 10^5 = 8.59 \times 10^6$
- 18) A scientist measures the mass of a rock as
 6.2×10^3 g and the mass of another rock as
 4.8×10^3 g. Find their total mass.
 $6.2 \times 10^3 + 4.8 \times 10^3 = 1.1 \times 10^4$
- 19) The Sun's diameter is 1.39×10^6 km and
Earth's diameter is 1.28×10^4 km. How
much bigger is the Sun's diameter?
 $1.39 \times 10^6 - 1.28 \times 10^4 = 1.3772 \times 10^6$
- 20) A microbe is 5×10^{-6} m long. Another
microbe is 3×10^{-6} m long. What is their
combined length?
 $5 \times 10^{-6} + 3 \times 10^{-6} = 8 \times 10^{-6}$

21) The speed of light is 3×10^8 m/s. How far
does light travel in 2×10^2 seconds?

$$(3 \times 10^8) \times (2 \times 10^2) = 6 \times 10^{10} \text{ m}$$

22) A machine produces 4.5×10^3 screws each
hour. How many screws does it produce in
 3×10^2 hours?

$$(4.5 \times 10^3) \times (3 \times 10^2) = 1.35 \times 10^6 \text{ screws}$$

23) A grain of sand has a mass of 3×10^{-5} g.
Find the total mass of 2×10^3 grains of
sand.

$$(3 \times 10^{-5}) \times (2 \times 10^3) = 6 \times 10^{-2} \text{ g}$$

24) A spacecraft travels 7.2×10^6 kilometres in
 1.8×10^3 seconds. What is the speed of the
spacecraft in km/s?

$$(7.2 \times 10^6) \div (1.8 \times 10^3) = 4 \times 10^3 \text{ km/s}$$

25) A car's engine produces 4×10^5 watts of
power. A train's engine produces 1.2×10^7
watts of power. How many times more
powerful is the train's engine than the
car's?

$$(1.2 \times 10^7) \div (4 \times 10^5) = 3 \times 10^1$$

**The train's engine is 30 times more
powerful**

26) Work out the value of $\frac{0.04 \times 0.008}{0.002}$. Give your
answer in standard form.

$$\frac{(4 \times 10^{-2}) \times (8 \times 10^{-3})}{2 \times 10^{-3}}$$

$$= \frac{32 \times 10^{-5}}{2 \times 10^{-3}}$$

$$= 16 \times 10^{-2}$$

$$= 1.6 \times 10^{-1}$$

27) Work out the value of $\frac{4.587 \times 10^{-11}}{3.4 \times 10^4}$. Give your
answer in standard form to 4 significant
figures.

$$1.3491 \dots \times 10^{-1}$$

$$= 1.349 \times 10^{-15}$$

- 28) A sphere has a radius of 3.5×10^4 mm. Work out the volume of the sphere. Give your answer in standard form to 3 decimal places.

$$V = \frac{4}{3}\pi r^3$$

$$V = \frac{4}{3} \times \pi \times (3.5 \times 10^4)^3$$

$$= 1.79594 \dots \times 10^{14}$$

$$= \mathbf{1.796 \times 10^{14}}$$

Challenge

- 29) The mass of a neutron is 1.675×10^{-27} kg. The mass of a helium nucleus is 6.646×10^{-27} kg. How many neutrons would have the same mass as 50 helium nuclei? Give your answer to the nearest unit.

Total mass of 50 helium nuclei:

$$50 \times (6.646 \times 10^{-27})$$

$$= 3.323 \times 10^{-25} \text{ kg}$$

Number of neutrons:

$$(3.323 \times 10^{-25}) \div (1.675 \times 10^{-27})$$

$$= 198.388 \dots$$

199 neutrons

- 30) Given that,

$$a = 2.5 \times 10^7 \quad \text{and} \quad b = 4 \times 10^{-3},$$

calculate $\frac{a^2 \times b^3}{5 \times 10^5}$. Give your answer in standard form.

$$\frac{(2.5 \times 10^7) \times (2.5 \times 10^7) \times (4 \times 10^{-3}) \times (4 \times 10^{-3}) \times (4 \times 10^{-3})}{5 \times 10^5}$$

$$= \frac{400 \times 10^5}{5 \times 10^5}$$

$$= 80$$

$$= \mathbf{8 \times 10^1}$$

- 31) The speed of light is 3×10^8 m/s. A particle travels at 6×10^{-4} times the speed of light for 2.5×10^6 s. How far does it travel? Give your answer in standard form in kilometres.

Speed:

$$(6 \times 10^{-4}) \times (3 \times 10^8) = 1.8 \times 10^5 \text{ m/s}$$

Distance:

$$(1.8 \times 10^5) \times (2.5 \times 10^6) = 4.5 \times 10^{11} \text{ m}$$

$$\mathbf{4.5 \times 10^8 \text{ km}}$$

- 32) The product of two quantities is:

$$1.728 \times 10^5$$

If one quantity is 4.5×10^2 , work out the other in standard form. Then check your answer using ordinary numbers.

Other quantity:

$$\frac{(1.728 \times 10^5)}{(4.5 \times 10^2)}$$

$$= \left(\frac{1.728}{4.5} \right) \times 10^3$$

$$= 0.384 \times 10^3$$

$$= \mathbf{3.84 \times 10^2}$$

Check:

$$1.728 \times 10^5 = 172800$$

$$4.5 \times 10^2 = 450$$

$$3.84 \times 10^2 = 384$$

$$450 \times 384 = 172800 \checkmark$$